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A study of the Roubidoux in the vicinity of Rolla

John Elmer Schultz

William Grover Branham

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Purpose of Investigation.

The purpose of this investigation was to discover the character of the texture and structural features of the Roubidoux within the area and the probable agencies which worked to produce them.

Area Embraced.

The area embraced in this consideration is contained within Rolla and Arlington townships of Phelps County, Missouri. Its East and West extension is from the western limits of the town of Rolla to the Gasconade river a distance of some eleven miles, the North and South extension is variable but averages on the whole about four miles, ranging from sections 9 to 33 in Rolla township and from sections 12 to 25 in Arlington township. The total area covered therefore embraces some 44 square miles.

Method of Gathering Data.

All elevations were secured with an aneroid barometer, of English manufacture and compensated for temperature, readings being taken to the nearest five feet. Changes in atmospheric conditions were noted by hourly readings on a mercurial barometer. By comparing these readings with the time noted for the aneroid observations in the field the necessary corrections for the aneroid were secured. In addition a check of the aneroid was made against the mercurial barometer at the beginning and conclusion of each day's field work and against several U. S. G. S. bench marks where noted in the area. By plotting the names of every land owner on our field maps together with the boundary lines of the pieces of land we were able to locate our stations with a fair degree of accuracy. Notes which might be of any value were registered opposite each station in the field book.

History.

The Roubidoux (Cambrian) as it is generally termed in the reports of the Missouri Bureau of Geology and Mines, though also designated in part as St. Elizabeth in a report on Miller County by Ball and Smith is a complex formation of dolomitic chert, sandstone with occasional conglomeritic sandstone and massive limestone, lying beneath the Jefferson City. The name Roubidoux was first made use of by F. L. Nason in his report in 1892 on the "Iron Ores of Missouri" but its application was limited to the designation of the sandstone member which is in the upper portion of this formation. It has been suggested that Nason intended to include the remaining members of the Roubidoux, as it is mapped today, in the Gasconade lying immediately beneath. In 1894 Winslow speaks of the Roubidoux as "probably the equivalent of the Crystal City sandstone" thus placing it above the Jefferson City since the Crystal City or St. Peters, as it is probably now more generally known, overlies this formation. This last designation resulted from the fact that Nason considered the sandstone outcropping at Crystal City, Pacific and elsewhere as a continuation of the member well within the Ozark region to which he already had given the name Roubidoux. It is almost needless to state that a clear differentiation has been

made covering the above as indicated previously. In a report on Moniteau County issued in 1905 by the state Bureau of Geology and Mines a statement is contained correlating the Roubideaux and Gasconade with the Potosi of the South-Eastern section of Missouri.

Physiography.

The topography of the section, limited as the latter is, nevertheless presents considerable variation. From the Eastern limit at the Western edge of the town of Rolla to a point about 3 1/2 miles to the West the topography is prevailingly marked by rounded hills with more or less gradual inclined slopes cut by small stream channels with larger creek courses at intervals which widen out into valleys of some considerable extent as indicated by those of Beaver Creek and Little Piney river. The former stream comes into the area from the Southeast and intersects sections 33, 29, and 30 of Rolla township joining with Little Piney in the Northwest quarter of section 30. From thence the Little Piney swelled by numerous minor water courses from the North and South flows in a North-westerly direction through the area cutting sections 25, 26, 22, 21, 20, and 19 of Arlington township finally flowing into the Gasconade River at

Arlington 4 miles to the west of Newburg. These and the Little Beaver creek coming in from the North are the only water courses of importance within the district under consideration. The drainage is therefore directed towards Little Piney and its two principal tributaries. Extending Northerly and Southerly from the confluence of Beaver Creek with Little Piney river is the location of one of the most important topographic features of the area, an elevation of from 960 to 1120 ft. and representing an increase of from 100 to 160 feet in height over the prevailing elevations East and West, the length as far as it was followed was upward of seven miles. Here too is given the first indication of a change in the general topography with precipitous cliffs of approximately 100 ft. in height, mainly of Gasconade limestone topped by a shallow covering of Roubidoux. Westward from here the hills become more and more precipitous, and the intervals between become narrow in the extreme. On the top of the hills and the slopes are remnants of the Roubidoux ranging from flat boulder like masses to fragmental material, the latter predominating and becoming more and more accentuated towards the Gasconade river. Near the latter the hills take on a conical form and where the base is cut by the river the hills present a solid cliff like form of Gasconade formation of from 125-160 ft.

above the river level.

Though in reality some 300 feet lower than the region adjacent to Rolla the rugged aspect of the hills here give the prevailing impression of a considerable increase in altitude. The activity of stream action is particularily apparent in the above district. The limestone of the Gasconade formation susceptible to [redacted]-solution by waters has been cut into deeper and deeper and as a result the overlying Roubidoux sandstone with its support gone has flexed in and downward, the shattered fragments remaining bearing witness of this process. Numerous structural and topographical sinks abound and small caves, within the Gasconade exclusively, are not infrequent. The whole area is thickly wooded, and covered with underbrush. The valleys offer the only agricultural possibilities of importance though some tillable land exists scattered about on top of the hills where the Roubidoux has in part worn away and dissappeared from the surface.

Elevation of Contacts.

Stations.	Corrected Elevations.
1	975 ft. Top of Roubidoux.
2	940 ft. Bottom of Roubidoux.
3	920 ft. " " "
4	920 ft. " " "
5	895 ft. " " "
6	885 ft. " " "
7	890 ft. " " "
8	905 ft. " " "
9	945 ft. " " "
10	1010 ft. " " "
11	915 ft. " " "
12	960 ft. " " "
13	1020 ft. Top of Roubidoux.
14	1075 ft. Bottom of Roubidoux.
15	1120 ft. " " "
16	1100 ft. " " "
17	1055 ft. " " "
18	1065 ft. " " "
19	1070 ft. " " "
20	1065 ft. " " "
21	1095 ft. " " "

Stations.	Corrected Elevations.
22	875 ft. Bottom of Roubidoux.
23	870 ft. " " "
24	850 ft. " " "
25	870 ft. " " "
26	880 ft. " " "
27	875 ft. " " "
28	830 ft. " " "
29	865 ft. " " "
30	890 ft. " " "
31	850 ft. " " "
32	890 ft. " " "
33	890 ft. " " "
34	850 ft. " " "
35	890 ft. " " "
36	880 ft. " " "
37	935 ft. " " "
38	855 ft. " " "
39	950 ft. " " "
40	905 ft. " " "
41	895 ft. " " "
42	895 ft. " " "
43	980 ft. " " "
44	1035 ft. " " "
45	1015 ft. " " "

Stations.	Corrected Elevations.
46	910 ft. Bottom of Roubidoux.
47	960 ft. " " "
48	1000 ft. " " "
49	910 ft. " " "
50	845 ft. " " "
51	800 ft. " " "
52	910 ft. " " "
53	910 ft. " " "
54	980 ft. Top of Roubidoux.

Note:- Station numbers and elevations conform to those given on the accompanying maps.

The maximum thickness of the Roubidoux as given by the above data is 80 feet in N. W. 1/4 Section 9 Rolla township in section 22 of same township we get a thickness of 70 feet. The minimum thickness is 35 feet in section 9 Rolla township.

The anticlinal fold mentioned elsewhere shows a maximum width of axis of a mile and one-half, the average being approximately one mile as far as the structure was traced North and South.

The minimum width of axis of any fold within the area was a quarter of a mile.

Character of Contact.

The formations which are found within the district under consideration are, beginning with the top, scattered patches of boulders and fragmental material Carboniferous in age and found on the highest elevations immediately adjacent to Rolla, next with an interval of unconformity the Jefferson City, Roubidoux and Gasconade, all Cambrian in age, and occupying positions in the order named.

A massively pitted dolomite marks the contact of the Jefferson City with the Roubidoux, while a limestone which gradates from dolomitic, through silicious to cherty nodular, defines the upper limits of the Gasconade at its contact with the Roubidoux.

Elsewhere in the Ozark Region the Roubidoux formation consists of chert, massive limestone, limestone with cherty layers, conglomeritic sandstone, simple sandstone and shales but as far as could be discovered in the limited time devoted to this particular district, the Roubidoux is represented in place by a simple sandstone member, uniform as regards texture and colored strongly by impregnations of iron bearing solutions. The conglomeritic sandstone which may be noted in localities adjoining Phelps County is apparently practically absent from this area. This member it will be remembered lies

near the top of the Roubidoux formation.

A very limited occurence of shales near the contact with the Gasconade was observed in a number of instances, more particularly in Southwest quarter of section 9 Rolla Township, near a small creek bed. The shales were a grayish white in color.

Chert in merely fragmental form occurs prominently within the Roubidoux in the area West from Newburg and extending towards the Gasconade River, in this connection sections 16, 17, and 18 Arlington township, may be noted. The chert is ~~rare~~ vari colored from a gray blue, through a light gray to pure white.

Fragmental material of the same character found overlying bedded and mingled in with residual Roubidoux to the East of Newburg, within the area, is largely to be ascribed to the Jefferson City.

At intervals, more particularly at the base and near the contact with the Gasconade, the sandstone becomes saccharoidal in character. In certain localities there is a strong tendency towards massive bedding, and incidentallythis may be said to typify the member, in others again, more particularly along drainage lines and in near proximity to stream beds, there is a tendency to a parting of the bedding along thin horizontal sections due to evident planes of weakness.

The impregnation of the iron bearing solutions from the surface has been strong enough, in certain instances, followed by oxidation of the deposited iron, to result in the breaking down of the rock mass which may be easily reduced to fragmental particles by slight pressure.

Strongly bedded contacts of the Roubidoux with the Gasconade become less and less pronounced as the area approaches the Gasconade River to the West. Plainly evident contacts which can be met with frequency in the region between Rolla and Newburg become increasingly less towards the river where they must be sought for with more effort, either near the head of small creek and stream channels or at reoccuring intervals at the top of the rugged hills. The denser undergrowth too forms a factor in this connection.

No gradual alteration of dolomite to sandstone is apparent as regards the upper contact of the Roubidoux with the Jefferson City. The dolomite breaks off abruptly as the sandstone comes in, the only seeming difference in appearance in the dolomite was a possible less pitting and this can be simply attributed to a lack of time interval. No variation in the sandstone was noted.

On the other hand, the effect of the contact of the sandstone on the underlying Gasconade limestone member has been most marked. With few exceptions the

dolomitic limestone becomes silicious to cherty, the former alteration showing a coarsely flaky silicious surface upon fracture.

A deposit of tripoli in the Gasconade within 30 feet of the contact of the Roubidoux and Gasconade was observed in section 17, Arlington township.

An occurence of Calcite in rather abundant quantitiyes and colored to a dirty greenish tinge evidently by organic matter was noted within the Gasconade but within 5 feet of the contact between the Roubidoux and Gasconade in section 7, Rolla township.

Cross bedding of the Roubidoux sandstone though present more particularly in the Eastern half of the section is limited in its occurence.

Deductions from Observed Data.

Three theories may be offered to account for the variable elevation of the contact between the Roubidoux and the Gasconade.

1. A gentle undulating outline caused by successive elevations and depressions of the land mass during Post Cambrian time.

2. Differential sinking and collapse due to the leaching out of Gasconade limestone underneath the Roubidoux sandstone.

3. An unconformable deposition of Roubidoux sandstone on an uneven surface of limestone.

As data collected does not tend to substantiate the last named theory it will not be made a part of this discussion.

Wherever contacts were visible the sandstone was conformable to the limestone and surface erosion of the limestone could not be identified. The abrupt change from limestone to sandstone, without gradation, can be d doubtless attributed to a rapid rise of the sea bottom, following limestone deposition. The rise however was not rapid enough to discourage a considerable thickness of sandstone deposition before the limestone was lifted above sea level thus protecting the surface of the latter from the processes of weathering.

As regards the first two named agencies our data would seem to indicate that both have entered into play.

An anticlinal fold which appears midway in the area and represents the point of highest elevation of the lower contact is doubtless due to the movements of the land mass during Post Cambrian time. This fold, though so gentle as to be hardly observable except by securing differences of elevation through instruments, is still however too typical of its kind to be laid to solution of underlying limestone strata, though strong action of

this character resulting in a trough immediately to the East has emphasized the fold. We would be inclined to place any variations in the elevations of the contact in the Eastern portion of the area, extending from the Arlington and Rolla township boundary line East to the town of Rolla, as also due to the same agency though modified slightly by solution activity of underlying limestone members of the Gasconade.

On the other hand Westward from the boundary line mentioned above to the Gasconade data and other observations in general would favor the greatly increased solution activity as largely responsible for the flexing, primarily induced of course by orogenic movement in Post Cambrian time. The greatly increased number of active and quasi-active water channels, the multiplied ravines and clefts of the original table lands and the fragmental character of the Roubidoux all tend to point to the enlarged activity of dissolving waters on the supporting limestone in this Western half of the area.

The possibility of the existence of a general sink area towards the Gasconade river is not proved. To substantiate such a condition data covering the region Westwards from the Gasconade is wanting. Only by correlating data for the regions both on the West and East of the Gasconade River could we expect to arrive at satisfactory conclusions on this feature of the consideration.

A suggestion of the conditions which obtained over this area during Cambrian sea era might be carried in the absence of the chert, doubtless secondary, member of the Roubidoux in the Eastern half and its evident increase in strength toward the Gasconade River. The suggestion offered is, that the Eastern half of the section represented closer shore conditions, that with progress Westward and Northward, the sea bottom shelved away to increasing depth as indicated by the greater and heavier limestone deposition.

Outline of Periods of Ozark Uplift.

The succession of uplifts and depressions which involve the Ozark region may be briefly summarized as follows:

First- Following Cambrian deposition and an unaccountable era of deposition which included Ordovician and probably Devonian and Silurian times, came uplift and an erosion interval; Second, a return to sea condition in Mississippian, another uplift and strong erosion; Third, submergence of the land area beneath sea level in Pennsylvanian or Upper Carboniferous, then a period of strong elevation resulting in a tilting of the formations; Fourth, a long sea era of peneplaination extending into Tertiary; Fifth, an uplift of the whole Ozark region during Tertiary.

It is probable from a purely local consideration that to Post Pennsylvanian uplift rather than to Post Tertiary must be assigned the greater burden of activity which produced the undulations within the area.

Summary.

The Roubidoux is represented in places by a rather coarse grained ferruginous sandstone, heavily bedded in part. A thin chert member evidently must be assigned near the base in Arlington township, judging from position of chert fragmental material with reference to the sandstone member.

The undulating surface of the formation has been produced primarily by Post Cambrian, probably Post Pennsylvanian, movement accompanied by solution activities upon the underlying limestone. Doubtless there has been a bond between the two, as the creation of varying sized troughs through the land movement; these troughs in turn becoming stream beds whose waters reacted on the limestone with ever increasing intensity.

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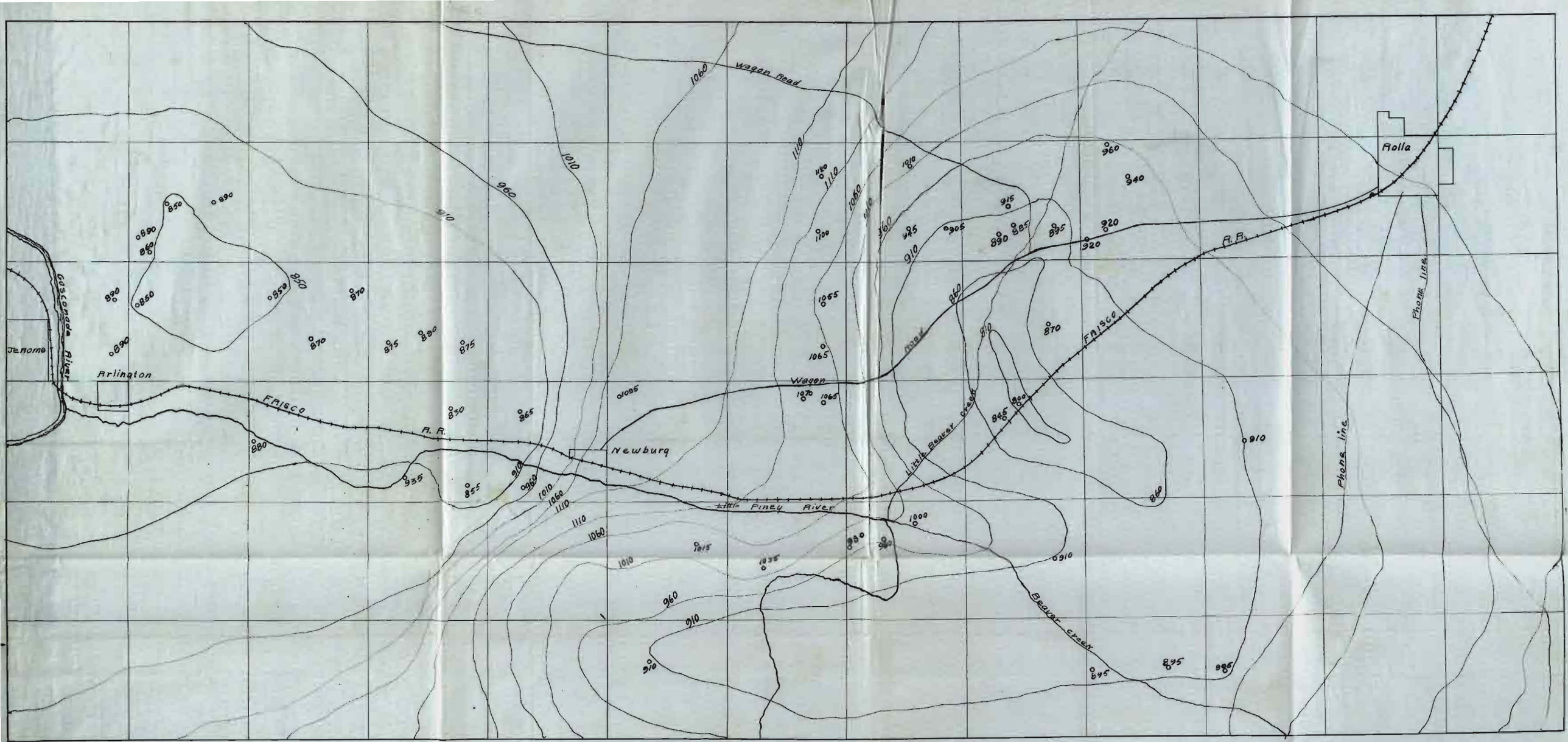
Wagon Road
Rolla
Phone line
Phone line
Gasconade River
Jerome
Arlington
FAISCO
R. R.
Newburg
Wagon
Road
Little Beaver creek
Little Piney River
Beaver creek
FAISCO
R. R.

Carboniferous.
Dolomite.
Roubideaux.
Gasconade.
" or lower.

APPROXIMATE ROCK MAP

Submitted by

Schultz and Branham

Brown — Roubideaux
Yellow — Gasconade
Black — Other formations

Spring 1910

Scale 2" = 1 mile